RESEARCH SUPPLY :

IMPLICATIONS FOR RESEARCH CHOICE *

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by

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* The views expressed in this paper represent those of the author and do not necessarily reflect the views of the Centre.

INTRODUCTION

The whole field of science and technology policy is still very unexplored or, rather, the limited work relative to the complexity has not yet lead to clear guidelines or conclusions which policymakers can use. Part of the reason is that issues cut across all development strategies and policies throughout government departments and it is difficult to weave in so many policies. There are also many areas where information is still very partial. We don't yet fully comprehend what contribution research makes to development.

Support for research is still justified as an article of faith and there is information to confirm that societies that invest heavily in research and development also happen to be those with the highest economic growth rates.

In this presentation, I will attempt to present some information on research systems themselves. Even in this smaller subset, there is not much usable information.

I will present some work done by the Office of Planning and Evaluation and some recent information that has been collected. I believe that this information is of considerable value to IDRC and raises some issues that need to be discussed, but the primary focus will be present some data and highlight some questions that need to be addressed by those interested in R&D, however relevant to IDRC.

We estimate that approximately US $14 billion is spent on research in the Third World. This figure is by no means a small economic cost to these countries. However, we still know very little about the composition and change of this industry. In fact, there is probably no other industry of such magnitude about which we know so little.

One reason is because the traditional ways of collecting and classifying data on research is not very helpful and hence, it has not generated enough interest among policymakers who do not see how they can use the information provided.

International organizations, such as UNESCO and OECD, as well as national organizations, such as the National Science Foundation and the division within Statistics Canada which is responsible for science and technology statistics, tend to collect data on the number of researchers, or scientists and engineers within a country. One can perhaps compare US vs. Japanese or Soviet statistics, but this does little to help illuminate choices that planners have to make. However, some progress has been made in getting more detailed analysis and the following section touches on this subject, albeit in a preliminary way.

GLOBAL DATA

The first and best set of data which I would like to look at is global data.

(1)	UNESCO	)	1985 -	240B
	OECD data	)		14B - Third World
	Third World share change	)	little over 6% and under-estimated (Pop. 79%; CSNP 21%)	

There is still a tendency to use the very outdated estimate that the Third World represents 2% of global R&D. This figure has not changed much in 30 years, but is it accurate?

External Flows

External flows are an important element. IDRC commissioned Dr. John P. Lewis, professor at Princeton University, to do a study of external support for research in the Third World. He found that about US $1.6 billion flowed to research institutions in the Third World in 1988. This represents about 10% of total spending on research, so external funding represents a higher proportion of the total than it does for development spending. IDRC represents only 5% of total external spending, and is therefore a minor player.

We are starting to get better data by sector. Recent estimates by the International Health Commission show that 1.6B is devoted to health research relevant to Third World countries, but only $600M in total is provided by developing countries themselves. The percentage of Third World countries ranged from a low of 0.7% of value of government health spending in Asia and the Middle East to as high as 1.3% in Africa, compared to an average of 2.7% in developed countries.

There is not much helpful data in this sector, but the information available on the agricultural sector is better and there is sufficient data to begin to raise some serious questions. Recent ISNAR data shows an impression dev.# over time; trend. It begins to suggest that old North/South concepts may become out of date. The fact that there is still a lot of reference made to the South representing only 2% of global R&D means that there is a perception that there is ongoing dependency in the South and a lack of respect for the potential of research in the South.

If one looks at this sector in more detail, some questions do arise.

1. Education levels - unfortunately, no time trend has been calculated yet, but certainly Africa is not far behind developed countries. East Africa is ahead of Southeast Asia.

2. Number of institutions - the number of institutions has increased a lot; there are approximately 120 universities in Africa -- this represents roughly 20% increase in the 1980s despite the serious problems in Africa.

3. Funding - What about funding? If we look at commitment and ability to pay, governments have been demonstrating their commitment. We cannot expect a much greater contribution, especially in hardest-pressed countries.

4. Africa - We know there are serious problems in Africa. The data available demonstrates this. includes land, K, expatriates so need more detailed breakdown - only 2% of total funds are available for discretionary funds in BD.

If the figures we have collected are correct, then one has to ask the question of whether emphasis on training is right or even perverse in effect. It might even be argued that more funding will not help at all unless there is a halt to the creation of more institutions or increase in staff. BD Inter Diarrheal Diseases Research Inst. case.

If the question of long-run viability is the issue, one might also question the appropriateness of IDRC trying to strengthen the weaker institutions, especially hinterland.

The second main area we should look at is heterogeneity and whether different strategies are needed for different kinds of countries.

From data obtained from the OECD, we know that 88% of industrial research is done by only the top 5 OECD countries and the remainder represent only 12%. It is interesting to examine the choices made by small industrial countries.

Some dichotomy applies in the Third World - top 5 (India, Brazil, Argentina, Mexico, Korea) = __% of Third World R&D (estimated)

If one also takes out NICs and a few others, only small systems are left. Of 127, 85 or 67% of LDCS < 10 million
52% < 5 million 1985

We looked at a sample of small from our studies - typically with a range of research expenditure from $4-15 million and with 200-1000 researchers.

What kind of research systems have been established? The data in Table I confirms what we know to be the case -- choices are made by personality, politics, happenstance (within sector - Singapore results show the same).

If rational choices are not deliberately made, what choices could policymakers make? Should they try to develop a multi-sectoral model of industrial and larger countries and if not, what? Is there any evidence to suggest that some areas provide a much higher payoff or that there is a minimum size that is needed. At one extreme, can one hope to have a payoff from one or two scientists only in one program? Unfortunately, there is evidence that there is a minimum critical mass needed, although hard evidence to support this statement is lacking.

Let's look at the largest sector, agriculture, where this issue should be less NB. There are 131 NARS - over half (75) have less than 100; one third less-25.

$300,000 - at	0.5% AGDP	- 4 of 105 in Africa
	1.0	- 10 of 105
	1.5	- 11.

Some estimates have been made that a minimum of 100,000 ha. are needed in a crop to justify a research program. Of the top 5 crops in Africa and, only a small number of crop programs would provide sufficient economic returns to justify a research program. Forty-eight developing countries have a total arable area of less than 100,000 has.

Other estimates have been made that a viable crop program requires total annual resources in the order of some $300,000 US. USAID has explicitly used such criteria in its African policy paper to decide that it would concentrate on only 13 countries which they considered to be technology generators. This required an area of over 100,000 has. and over 100 scientists. They felt the rest could only hope to to be technology borrowers, relying on external sources to meet their needs.

These estimates could be incorrect and we might be correct in supporting the training of one S&T policy researcher in Botswana, but I believe we and these smaller countries need a lot more research on these issues before we can be confident about what is best for them.

IDRC has not been increasing its support to smaller countries but it still represents some 30%. For these, small pressures are serious - there may not be a critical mass in their existing system which is already over-funded or over-staffed; many areas are not covered (transport/communications/construction); 9-15% of GNP - no research; larger and NICs will turn more to industrial learning, smaller to draw wagons in smaller circle.

ALTERNATIVES

This issue has been recognized generally, even if not carefully researched and some alternatives have been established.

1. Multilateral research system which has increased enormously in the past, although it appears to be slowing down although there are many gaps by sector and region.

2. Networks are another alternative. IDRC is active in this area, but there is insufficient analysis. We hope to carry out a study shortly looking at new literature and evaluations. There is little information on the degree to which national results are spread -- the spillover effect estimated in one study to be a minimum of 65% of the benefit of agricultural research that would be gained by other countries. Other estimates have been made that lags in uptake of imported technology a minimum of 4 years, but almost none of this is really documented despite its critical importance to the whole concept and potential benefit from networks.

3. Information flows-here IDRC plays a special role. There is other information one can present to indicate that there are some fundamental issues about research strategies that need to be addressed, but it is not sufficient to prove that existing approaches are wrong in any case. The evidence is too weak and partial at this point in time to prove that any particular strategy is the most appropriate. However, there

is enough evidence to suggest that developing countries and IDRC, as a funding agency, need to carry out a lot more investigation before we can be confident that we are following appropriate strategies. The alternative of carrying on without this information could be disastrous for many countries in terms of wasted resources and opportunities.

CONCLUSIONS

Developing countries and agencies such as IDRC should perhaps change the kind of support provided to concentrate on providing more operating funds per scientist and a condusive working environment if we're to see the benefits of increasing resources to research. We may have to make hard choices about the areas we can't afford to go into. This might even mean phasing down certain kinds of research to direct resources to other areas.

External agencies like IDRC bear a special responsibility towards the 50% of smaller countries who face the hardest choices, but are also the most constrained in terms of what they can do themselves. If a national choice is made, research is most likely to be the most under-funded industry as most benefits are external.

We may have to look at development of supranational mechanisms to encourage a more rational evolution of a multilateral research system that recognizes the inputs and mutual benefits that the industrial countries and the larger or more prosperous developing countries can have with each other and which allows for the smaller and poorer countries to benefit also.

TABLE I

FINANCIAL AND HUMAN RESOURCES IN R&D

	Population 1985 (million)	Total R&D (US $ million)	Percentage GNP	Number Researchers	Sectoral Funding
Botswana	1.1	4.3	0.4	235	Agriculture 75 Technology and energy 23
Malawi	7.0	4.5	0.4	477	Agriculture 96
Costa Rica	2.6	5.2	0.2	850	Agriculture 46 Social development 19 Health 15
Guatemala	8.0	14.8	0.2	1094	Agriculture 22 Energy and Industry 29 Health 8
Honduras	4.4	9.2	0.1	612	Agriculture 76 Social development 11 Health 9